

WHAT IS CLAIMED IS:

1. A liquid metering system comprising
 - a) a conduit along which said liquid flows, a portion of said conduit having a light transmitting wall,
 - b) a liquid heating means capable of heating a portion of said liquid at a certain position along said conduit,
 - c) a light source providing illumination of said liquid in said conduit through said light transmitting wall at a position downstream from said liquid heating means, and
 - d) an optical sensing means positioned to receive a portion of said illumination from the illuminated area of said liquid in said conduit through said light transmitting wall such that said optical sensing means detects a change in an optical property of said illumination from said illuminated area due to the change in the index of refraction of said heated portion of said liquid, thereby enabling measurement of the motion of said liquid along said conduit.
2. The system of claim 1 wherein said light source is a coherent light source and said change in an optical property of the illumination from said illuminated area is a phase change.
3. The system of claim 1 wherein said change in an optical property of the illumination from said illuminated area is a change in the intensity of the illumination reflected at the interface of said liquid and said conduit.
4. The system of claim 1 wherein said change in an optical property of the illumination from said illuminated area is a change in the intensity of the illumination refracted at the interface of said liquid and said conduit.
5. The system of claim 1 wherein said light transmitting wall of said conduit is transparent.

6. The system of claim 1 wherein the light transmitting wall of said conduit is glass.
7. The system of claim 1 wherein the light transmitting wall of said conduit is a polymer.
8. The system of claim 1 wherein the portion of said conduit with a light transmitting wall has a lumen with a rectangular or square cross section.
9. The system of claim 1 wherein said illumination from said light source is visible.
10. A system capable of infusing a pharmaceutical liquid into a patient comprising
 - a) a conduit along which said liquid flows, a portion of said conduit having a light transmitting wall,
 - b) a liquid heating means capable of heating a portion of said liquid at a certain position along said conduit,
 - c) a light source providing illumination of said liquid in said conduit through said light transmitting wall at a position downstream from said liquid heating means, and
 - d) an optical sensing means positioned to receive a portion of said illumination from the illuminated area of said liquid in said conduit through said light transmitting wall such that said optical sensing means detects a change in an optical property of said illumination from said illuminated area due to the change in the index of refraction of said heated portion of said liquid, thereby enabling the measurement of flow of the liquid through the conduit.
11. The system of claim 10 wherein said light source is a coherent light source and said change in an optical property of the illumination from said illuminated area is a phase change.
12. The system of claim 10 wherein said change in an optical property of the illumination from said illuminated area is a change in the intensity of the illumination reflected at the interface of said liquid and said conduit.

13. The system of claim 10 wherein said change in an optical property of the illumination from said illuminated area is a change in the intensity of the illumination refracted at the interface of said liquid and said conduit.
14. The system of claim 10 wherein said light transmitting wall of said conduit is transparent.
15. The system of claim 10 wherein the light transmitting wall of said conduit is glass.
16. The system of claim 10 wherein the light transmitting wall of said conduit is a polymer.
17. The system of claim 10 wherein the portion of the conduit with a light transmitting wall has a lumen with a rectangular or square cross section.
18. The system of claim 10 wherein said illumination from said light source is visible.
19. The method of measuring liquid flow along a conduit with a light transmitting portion comprising the steps of
- a) heating a portion of the liquid at one location along the conduit,
 - b) illuminating a downstream location of the conduit through the light transmitting portion of the conduit with illumination from a light source,
 - c) detecting a change in an optical property of illumination received from the downstream location of the conduit when the heated portion of the liquid passes the downstream location due to the change in the index of refraction of the heated portion of the liquid, and
 - d) calculating the time required for the heated portion of the liquid to travel from the location of the heat source to the location of the illumination.
20. The method of claim 19 used in a system to deliver pharmaceutical solutions.
21. The method of measuring liquid flow along a conduit of a) heating a portion of the liquid at one location along the conduit, b) sensing the heated portion of the liquid

at a downstream location along the conduit, c) measuring a signal caused by a change in the index of refraction of the heated portion of the liquid as it moves down the conduit, and d) calculating the time required for the heated portion of the liquid to travel from the heating location to the sensing location.